



AN309007

Migration Guide

How to Migrate to Numonyx M29W160E from Spansion* S29AL016D/J/M and S29GL016A Flash Memory

This application note explains how to migrate an application based on the Spansion*¹ S29AL016D/J or the S29GL016A flash memory devices to an application based on the Numonyx™ M29W160E flash memory device. This document does not provide detailed information on the devices, but highlights the similarities and differences between them. The comparison takes into consideration the signal descriptions, packages, architecture, software command set, performance, and block protections.

Introduction

The Numonyx M29W160E memory, manufactured on the mature 110nm technology, ideal for all applications needing a reliable (min 100,000 cycles, 20 years data retention), fast, parallel NOR device (available in 70 or 90 ns access times). More than 360 million devices† shipped worldwide on this technology between 2005 and the founding of Numonyx in 2008. Customers can rely on Numonyx (the merger of Intel and STMicroelectronics flash memory groups) to continue delivering highly reliable and mature products on this technology.

Using the industry standard command set, the M29W160E can replace many competitors' parts such as the Spansion S29AL016D/J or the S29GL016A. Customers that value reliability will benefit from using the M29W160E based on single level cell, floating gate technology (100,000 cycles, 20 years retention minimum) compared to the S29GL016A based on MirrorBit technology (100,000 cycles, 20 years typical).

M29W160E is offered in -40 °C to 85 °C, industrial temperature range. The version in -40 °C to 125 °C extended temperature range and related automotive compliance is called M29W160F, please refer to separate datasheet and contact your local sales for availability of your preferred combination.

M29W160E and M29W160F are processed in same technology and have equivalent timing.

†Overall total including different memory densities

Memory architecture and protection groups

The Spansion S29AL016J/D and Numonyx M29W160E memory products can be used in byte (x8) or word (x16) mode. The blocks in both these memories are asymmetrically arranged with 31 main blocks of 64Kbytes each, 1 boot block of 16Kbytes, 2 parameter blocks of 8Kbytes and a small main block of 32Kbytes. The S29AL016J also includes a 256 byte secure region which is permanently locked at the factory. M29W800D offers a Unique-ID via CFI query.

The Spansion S29GL016A has a different block structure. It has 31 main blocks of 64Kbytes each, and 8 boot blocks of 8Kbytes each. The Spansion S29AL016M is available in either block structure. On the S29AL016J/D, S29GL016A and M29W160E, any block can be protected independently from the others.

¹ *Other names and brands may be claimed as the property of others.

Contents

Introduction	1
Memory architecture and protection groups.....	1
Hardware migration	3
Signal Descriptions	3
Packages.....	4
Software command set.....	5
Device codes and auto select codes.....	6
Performance and specifications.....	7
Access Time	7
Program and Erase Times	7
DC specifications	8
AC specifications	9
Power up and reset specifications.....	10
Revision history	11
Legal Disclaimer	12

Hardware migration

This section provides a detailed comparison between S29AL016J/D/M, S29GL016A and M29W160E signals and package pin-out.

Signal Descriptions

Table 1: Signal description for the S29AL016J/D/M, S29GL016A, and M29W160E devices

Signal Name			Description	Input / Output
S29AL016J/ S29GL016A	S29AL016D/ S29AL016M	M29W016E		
A0-A19			Address Inputs	Inputs
DQ0-DQ14			15 Data Input/Outputs	I/O
DQ15/A ₋₁			DQ15 (Data I/O, word mode) A ₋₁ (LSB address, byte mode)	I/O
BYTE#		$\overline{\text{BYTE}}$	Byte/Word Organization Select	Input
CE#		$\overline{\text{E}}$	Chip Enable	Input
OE#		$\overline{\text{G}}$	Output Enable	Input
WE#		$\overline{\text{W}}$	Write Enable	Input
RESET#		$\overline{\text{RP}}$	Reset/Block Temporary Unprotect	Input
RY/BY#		RB	Ready/Busy Output	Output
VCC			Supply Voltage	Supply
VSS			Ground	
WP#/ACC ¹	N/A ²		Write Protect/Program Acceleration	Input

⁽¹⁾ S29GL016A allows for accelerated programming through applying a high voltage on WP#. S29AL016D/J/M and M29W160E do not support accelerated programming. Customers that require this feature should use the 32Mbit M29W320D.

⁽²⁾ S29AL016D/M and M29W160E do not have a write protect pin. Customers that require this feature should use the 32Mbit M29W320D.

Packages

The S29AL016J/D/M, S29GL016A and the M29W160E devices are offered in TSOP48 (20mm x 12mm) and BGA packages. The M29W160E BGA package is smaller (6mm x 8mm) than that of the S29AL016J/D and S29GL016A BGA package (6.15mm x 8.15mm). To support customers still using the large 64-ball FBGA 11x13mm Spansion package a mechanically equivalent ZS option has been introduced. Please contact your local sales for details of availability and price.

The M29W160E is fully pin-to-pin compatible with the S29AL016D/M. M29W160E is pin-to-pin compatible with the S29AL016J and S29GL016A, with the exception of the WP# pin. M29W160E does not include the WP# signal which is a NC (no-connect) on the package.

Refer to the S29AL016J/D/M and M29W160E datasheets for details on the packages.

Software command set

The M29W160E and S29AL016D feature an identical set of standard commands. The S29AL016J/M and S29GL016A contain additional commands to enter/exit the secured region. The S29GL016A also contains additional commands for buffer program.

Table 2: Software commands for the S29AL016J/D/M, S29GL016A, and M29W160E devices

Commands	M29W160E	S29AL016D	S29AL016J/M	S29GL016A
Read/Reset	✓	✓	✓	✓
Autoselect	✓	✓	✓	✓
CFI Query	✓	✓	✓	✓
Program	✓	✓	✓	✓
Unlock Bypass	✓	✓	✓	✓
Unlock Bypass Program	✓	✓	✓	✓
Unlock Bypass Reset	✓	✓	✓	✓
Chip Erase	✓	✓	✓	✓
Block Erase	✓	✓	✓	✓
Erase Suspend	✓	✓	✓	✓
Erase Resume	✓	✓	✓	✓
Enter Secure Sector			✓	✓
Exit Secure Sector			✓	✓
Write to Buffer				✓
Program Buffer to Flash				✓

Device codes and auto select codes

The auto select codes are composed of the manufacturer code, the device code and the block protection status. The S29AL016J/D/M, S29GL016A and M29W160E devices have a different manufacturer code and device code.

The S29AL016J/D/M, S29GL016A and M29W160E devices use identical commands and address inputs to read the auto select codes.

Table 3: Auto select codes, x16

	Spansion		Numonyx	
Auto select code	S29AL016J/D S29GL016A (01 model) ¹	S29AL016J/D S29GL016A (02 model) ²	M29W160ET	M29W160EB
Manufacturer code	XX01h		0020h	
Device code	22C4h	2249h	22C4h	2249h
Block protection status	XX01h (protected) XX00h (unprotected)		0001h (protected) 0000h (unprotected)	

⁽¹⁾ Top boot block.

⁽²⁾ Bottom boot block.

Table 4: Auto select codes, x8

	Spansion		Numonyx	
Auto select code	S29AL016J/D S29GL016A (01 model) ¹	S29AL016J/D S29GL016A (02 model) ²	M29W160ET	M29W160EB
Manufacturer code	01h		20h	
Device code	C4h	49h	C4h	49h
Block protection status	01h (protected) 00h (unprotected)			

⁽¹⁾ Top boot block.

⁽²⁾ Bottom boot block.

Performance and specifications

The M29W160E and S29AL016D/J/M have almost compatible DC and AC characteristics (see below for details).

Access Time

The M29W160E has a random access time of 70 ns. The S29AL016D/J has a random access time of either 70 ns or 55 ns. The 55 ns access time is only available with the reduced voltage range of VCC = 3.0 V – 3.6 V, while the M29W160E guarantees the 70 ns access time also for VCC as low as 2.7 V. The S29GL016A and S29AL016M have two speed options of 90ns and 100ns. By substituting these parts with the M29W160E the application can take advantage of the faster access time of 70ns offered by Numonyx parts.

Program and Erase Times

Program and erase time differences are shown here.

Table 5: Program and Erase specifications

Parameter	S29AL016D		S29AL016J		S29AL016M		S29GL016A		M29W160E		Unit
	Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	
Block Erase	0.7	10	0.5	10	0.7	7.5	0.5	3.5	0.8	1.6	s
Chip Erase	25		16		32		17.5	35	29	60	s
Byte/Word program	7	210	6	150	18				13	200	µs
Chip Program (word)	7.2	21.6			19		16		13	60	s
Chip Program (byte)	11	33			36				26	120	s

DC specifications

Table 6: DC specifications, S29AL016D, S29AL016J

Parameter	Description	S29AL016D			S29AL016J			Unit
		Min	Typ	Max	Min	Typ	Max	
I _{CC1}	Supply Current (read)		9	16		7	12	mA
I _{CC2}	Supply Current (standby)		0.2	5		0.2	5	μA
I _{CC3}	Supply Current (program/erase)		20	25		20	30	mA
V _{IL}	Input Low Voltage	-0.5		0.8	-0.1		0.8	V
V _{IH}	Input High Voltage	0.7*V _{CC}		V _{CC} + 0.3	0.7*V _{CC}		V _{CC} + 0.3	V
V _{LKO}	Program/Erase Lockout Supply Voltage	2.3		2.8	2.1		2.5	V

Table 7: DC specifications, S29AL016M, S29GL016A

Parameter	Description	S29AL016M			S29GL016A			Unit
		Min	Typ	Max	Min	Typ	Max	
I _{CC1}	Supply Current (read)		15	20		18	25	mA
I _{CC2}	Supply Current (standby)		0.4	5		1	5	μA
I _{CC3}	Supply Current (program/erase)		40	60		50	60	mA
V _{IL}	Input Low Voltage	-0.6		0.6	-0.5		0.8	V
V _{IH}	Input High Voltage	0.7*V _{CC}		V _{CC} + 0.5	0.7*V _{CC}		V _{CC} + 0.5	V
V _{LKO}	Program/Erase Lockout Supply Voltage	2.3		2.5	2.3		2.5	V

Numonyx™ M29W016E to Spansion S29AL016D/J/M and S29GL016A

Table 8: DC specifications, M29W160E

Parameter	Description	M29W160E			Unit
		Min	Typ	Max	
I _{CC1}	Supply Current (read)		4.5	10	mA
I _{CC2}	Supply Current (standby)		35	100	μA
I _{CC3}	Supply Current (program/erase)			20	mA
V _{IL}	Input Low Voltage	-0.5		0.8	V
V _{IH}	Input High Voltage	0.7*V _C c		V _{CC} + 0.3	V
V _{LKO}	Program/Erase Lockout Supply Voltage	1.8		2.3	V

AC specifications

AC specification differences are shown here, comparing the fastest versions available at the full voltage range (2.7 V – 3.6 V)

Table 9: AC specification differences, S29AL016D/J and M29W160E

Sym	Alt	Parameter	Test Condition	S29AL016D	S29AL016J	M29W160E	Unit
t _{GHOZ}	t _{DF}	Output Enable High to Output Hi-Z	Max	16		25	ns
t _{BLQZ}	t _{FLQZ}	$\overline{\text{BYTE}}$ low to Output Hi-Z	Max	16		25	ns
t _{BHOV}	t _{FHOV}	$\overline{\text{BYTE}}$ High to Output Valid	Max	70		30	ns
t _{WLWH}	t _{WP}	Write Enable Low to Write Enable High	Min	35		45	ns
t _{WHWL}	t _{WPH}	Write Pulse Width High	Min	30	25	30	ns
t _{DVWH}	t _{DS}	Input Valid to Write Enable High	Min	35		45	ns
t _{ELEH}	t _{CP}	Chip Enable Low to Chip Enable High	Min	35		45	ns
t _{DVEH}	t _{DS}	Input Valid to Chip Enable High	Min	35		45	ns
t _{WHRL}	t _{BUSY}	Program/Erase	Max	90		30	ns

Numonyx™ M29W160E to Spansion S29AL016D/J/ and S29GL016A

Sym	Alt	Parameter	Test Condition	S29AL016D	S29AL016J	M29W160E	Unit
		Valid to \overline{RB} Low					
t_{EHEL}	t_{CPH}	Chip Enable High to Chip Enable Low	Min	30	25	30	ns
t_{PLYH}	t_{READY}	\overline{RP} low to Read Mode	Max	20	35	30	ns

Power up and reset specifications

Power up and reset timing differences between S29GL016A and M29W160E are shown here.

Power up and reset timings

Symbol	Alt	Parameter	Test Condition	S29GL016A	M29W160E	Unit
t_{PLYH}	t_{READY}	\overline{RP} Low to Read	Max	20	10	μ s

Revision history

Table 9. Document revision history

Date	Revision	Changes
20-Feb-2009	1	Initial release
09-Apr-2009	2	Updated Device ID; Table of Contents; Max block/chip erase time

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